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First Named Inventor	Ronald Caudill
Art Unit	3781
Examiner Name	Stephen J. Castellano
Attorney Docket Number	282660-00247

ENCLOSURES *(Check all that apply)*

- ☐ Fee Transmittal Form
  - ☐ Fee Attached
- ☐ Amendment/Reply
  - ☐ After Final
  - ☐ Affidavits/declaration(s)
- ☐ Extension of Time Request
- ☐ Express Abandonment Request
- ☐ Information Disclosure Statement
- ☐ Certified Copy of Priority Document(s)
- ☐ Response to Missing Parts/ Incomplete Application
  - ☐ Response to Missing Parts under 37 CFR 1.52 or 1.53
- ☐ Drawing(s)
- ☐ Licensing-related Papers
- ☐ Petition
- ☐ Petition to Convert to a Provisional Application
- ☐ Power of Attorney, Revocation Change of Correspondence Address
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- ☐ After Allowance communication to Technology Center (TC)
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- ☐ Appeal Communication to TC **(Appeal Notice, Brief, Reply Brief)**
- ☐ Proprietary Information
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  Appellants' Petition for Reharing and/or Petition to Reopen Prosecution

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	David C. Jenkins Eckert Seamans Cherin & Mellott, LLC
Signature	
Date	September 17, 2007

CERTIFICATE OF TRANSMISSION/MAILING

I hereby certify that this correspondence is being facsimile transmitted to the USPTO or deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450 on the date shown below.

Typed or printed name	David C. Jenkins		
Signature		Date	September 17, 2007

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Examiner: Stephen J. Castellano	Appeal No. 2007-1112 Dated July 19, 2007
Group Art Unit: 3781	
In re Application of: RONALD CAUDILL ET AL.	ALUMINUM CYLINDER WITH A PLASTIC COATING
Serial No. 10/692,116	
Filed: October 23, 2003	Attorney Docket No. 282660-00247

APPELLANTS' PETITION FOR REHEARING
and/or PETITION TO REOPEN PROSECUTION

September 17, 2007

Commissioner for Patents
MAIL STOP APPEAL BRIEF - PATENTS
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

This is a Petition for Rehearing under 37 CFR § 41.52(a)(1), (a)(2), and (a)(3) and/or a Petition to Reopen Prosecution under 37 CFR § 41.50(b)(1) in response to the Decision on Appeal, Appeal No. 2007-1112, decided on July 19, 2007 for the captioned application.

In the Decision on Appeal, dated July 19, 2007, the Board relied upon *KSR International Co. v. Teleflex Inc.*, 500 U.S. ___, 2007 (2007), which is an opinion that had not issued as of the time the Appellants filed their Brief and Reply. Further, without specifically identifying a new ground of rejection, the Board has indicated that its decision was, at least partially, based on Appellants' failure to present evidence that any unpredictable results were obtained by Appellants' invention. This point was not raised by the Examiner nor addressed in the appellate filings.

No fee is believed to be required, however, if such a fee is due, please charge any additional fee or credit any overpayment to Eckert Seamans Cherin & Mellott, LLC Deposit Account No. 02-2556. A duplicate copy of this sheet is enclosed.

REMARKS

On October 23, 2006 Appellants filed their Appeal Brief. The argument in this Brief included references to cases such as *In re Geiger*, 815 F.2d 686, 2 USPQ2d 1276 (Fed. Cir. 1987), which held that "obviousness cannot be established by combining teachings of the prior art to produce the claimed invention, *absent some teaching, suggestion, or incentive supporting combination,*" and *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991), which stated that "both the suggestion [to make the claimed apparatus] and the reasonable expectation of success must be found in the prior art, not in the Applicants' disclosure." The Examiner filed the Answer on November 16, 2006. The Appellants filed their Reply on January 12, 2007.

On April 30, 2007 the U.S. Supreme Court issued the decision in *KSR International Co. v. Teleflex Inc.*, 500 U.S. ___, 2007 WL 1237837 (2007). *KSR International* held, *inter alia*, that the "teaching, suggestion, motivation" test should not be the only test applicable to the determination of obviousness under 35 U.S.C. § 103(a). In the decision affirming the Examiner's rejections in this appeal, the only case cited by the Board in its analysis is *KSR International.* Appellants believe that the *KSR International* decision is a "recent relevant decision" under 37 CFR § 41.52 (a)(2). As the *KSR International* decision was not issued until well after Appellants filed their Brief and Reply, Appellants request a rehearing to address this Appeal under this recent relevant decision.

Further, it is noted that, although the Examiner did not address the lack of "unpredictable results" in either the final Office Action or the Answer, the Board, again citing *KSR International*, included the statement that the Appellants failed to demonstrate that unpredictable results were obtained by the claimed invention. Accordingly, Appellants believe that the Board has provided a new ground for rejection under 37 CFR § 41.50 (b) and alternately request that prosecution be reopened so that Appellants may introduce evidence addressing this new rejection.

Real Party In Interest

The real party in interest is Harsco Technologies Corporation. An assignment from the inventors to Harsco Technologies Corporation was recorded on December 24, 2003 and is recorded at Reel/Frame 014831/0933.

Related Appeals and Interferences

There are no other appeals or interferences known to Appellants or to Appellants' legal representative which will directly affect, be directly affected by, or have a bearing on the Board's decision in the pending appeal.

Status of the Claims

Claims 1, 2, 6-9 and 14-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* (U.S. Patent No. 5,474,846) in view of *Seal et al* (U.S. Patent No. 5,822,838).

Claims 3-5 and 10-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* ('846) in view of *Seal* ('838) as applied to claims 2 and 9 and further in view of *Luttmann et al.* (U.S. Patent No. 6,244,020).

Status of the Amendments

There are currently no amendments to the pending claims. The claims as they stand on Appeal are contained in the Appendix 1 to this Brief.

Summary of the Claimed Subject Matter

This invention relates to high pressure gas cylinders and, more specifically, to aluminum cylinders (14) (page 2, line 27) having a plastic interior coating (24) (page 2, line 26). Page 2, lines 25-27. It has been determined that when a composite/aluminum cylinder (14) (page 2, line 20) is combined with a plastic coating (24) (page 2, line 26), the total weight of the cylinder is reduced, compared with all metal cylinders, and the cycle life is significantly extended over that achievable by the base designs. Page 1, lines 26-31. More specifically, it has been found that use of the plastic coating (24) (page 2, line 26) on a composite/aluminum cylinder (14) (page 2, line 20) increases the cycle life of a cylinder between about 50% to 150%. *Id.*

In the prior art, it was known to include a plastic coating within a thick shell metal cylinder. A thick shell metal cylinder is a cylinder having a metal shell of sufficient thickness to provide structure to the vessel and sufficient to resist deformation at high pressure. Such a plastic coating was used to protect the metal shell from corrosion due to reactive gases. See Affidavit of Ed Schindler, attached as Exhibit A. Plastic linings did not provide substantive structural strength to the cylinder. *Id.* Accordingly, it was not known, nor would those skilled in the art expect, a plastic coating to extend the cycle life of the high pressure cylinder.

Further, in a high pressure vessel having a composite overwrap, the composite overwrap provides the structure to the vessel that is sufficient to resist deformation at high pressure. *Id.* Within the composite overwrap is a shell made from either metal or plastic. *Id.* A metal shell can be employed to substantially eliminate fluid loss via permeation of stored gases. *Id.* A plastic shell can be used when the stored gas chemically reacts with a metal shell, however, plastic shells are typically more gas permeable as compared to metal shells. *Id.* Given the purpose of the shell and its respective material limitations, there would not be an instance wherein a plastic coating would be used on a metal shell. That is, as stated above, metal shells can be used unless the gas reacts with metal. With a reactive gas, a plastic shell would be

used, unless the rate of gas loss via permeation is unacceptable. If a gas is reactive with metal and permeates to an unacceptable extent with a plastic shell, such a gas is not suitable for storage in a high pressure cylinder. *Id.* That is, if such a gas was stored in a composite overwrap cylinder having a plastic lined metal shell, such a gas would permeate the plastic and then react with the metal. *Id.* Knowing this, those skilled in the art would not add a plastic coating to a high pressure vessel having a composite overwrap and a metal shell. *Id.*

The aluminum/composite/plastic cylinder (10) (page 2, line 19) is a lightweight, thin-walled cylinder (14) (page 2, line 20) containing an interior plastic coating (24) (page 2, line 26) that is heat-bonded to the aluminum shell (22) (page 2, line 26). Page 3, lines 6-8. The aluminum shell (22) (page 2, line 26) is surrounded by a composite outer wrap (20) (page 2, line 26), typically carbon or aramid and fiberglass filaments held within an epoxy resin matrix. Page 3, lines 1-5. The cylinder (14) (page 2, line 20) is designed to contain gas ranging in pressure from 500 to 10,000 psi. Page 2 lines, 5-6. The cylinders (14) (page 2, line 20), typically, range in volume from 0.5 to 500 liters. *Id.* Such cylinders (14) (page 2, line 20) are especially adapted to be used as a self-contained breathing apparatus, a home oxygen therapy cylinder, a commercial aviation cylinder, a fuel storage cylinder in natural gas and hydrogen vehicles, and with military and aerospace applications. Page 2, lines 6-9.

The Claims addressed on Appeal are identified below:

1. A gas cylinder (14) (page 2, line 20) comprising:

an aluminum shell (22) (page 2, line 26) having an outer side (26) (page 2, line 27) and an inner side (28) (page 2, line 27) defining a storage space (30) (page 2, line 27);

a composite wrap (20) (page 2, line 26) disposed about said aluminum shell (22) (page 2, line 26); and

a plastic coating (24) (page 2, line 26) disposed on said inner side (28) (page 2, line 27).

2. The gas cylinder (14) (page 2, line 20) of Claim 1, wherein said plastic coating (24) (page 2, line 26) is heat bonded to said inner side (28) (page 2, line 27).

3. The gas cylinder (14) (page 2, line 20) of Claim 2, wherein said plastic coating (24) (page 2, line 26) is a polyethylene copolymer.

4. The gas cylinder (14) (page 2, line 20) of Claim 3, wherein said storage space (30) (page 2, line 27) is between about 0.5 and 500 liters.

5. The gas cylinder (14) (page 2, line 20) of Claim 4, wherein said composite wrap (20) (page 2, line 26) is carbon or aramid and fiberglass.

6. The gas cylinder (14) (page 2, line 20) of Claim 1, wherein said storage space (30) (page 2, line 27) is between about 0.5 and 500 liters.

7. The gas cylinder (14) (page 2, line 20) of Claim 1, wherein said composite wrap (20) (page 2, line 26) is carbon or aramid and fiberglass.

8. A cylinder assembly (10) (page 2, line 19) comprising:

a valve assembly (12) (page 2, line 19) structured to sealingly engage a cylinder (14) (page 2, line 20); and

a cylinder (14) (page 2, line 20) comprising:

an aluminum shell (22) (page 2, line 26) having an outer side (26) (page 2, line 27) and an inner side (28) (page 2, line 27) defining a storage space (30) (page 2, line 27);

a composite wrap (20) (page 2, line 26) disposed about said aluminum shell (22) (page 2, line 26); and

a plastic coating (24) (page 2, line 26) disposed on said inner side (28) (page 2, line 27).

9. The cylinder assembly (10) (page 2, line 19) of Claim 8, wherein said plastic coating (24) (page 2, line 26) is heat bonded to said inner side (28) (page 2, line 27).

10. The cylinder assembly (10) (page 2, line 19) of Claim 9, wherein said plastic coating (24) (page 2, line 26) is a polyethylene copolymer.

11. The cylinder assembly (10) (page 2, line 19) of Claim 10, wherein said storage space (30) (page 2, line 27) is between about 0.5 and 500 liters.

12. The cylinder assembly (10) (page 2, line 19) of Claim 11, wherein said composite wrap (20) (page 2, line 26) is carbon or aramid and fiberglass.

13. The cylinder assembly (10) (page 2, line 19) of Claim 12, wherein said cylinder (14) (page 2, line 20) is structured to contain a gas at a pressure between about 500 to 10,000 psi.

14. The cylinder assembly (10) (page 2, line 19) of Claim 8, wherein said storage space (30) (page 2, line 27) is between about 0.5 and 500 liters.

15. The cylinder assembly (10) (page 2, line 19) of Claim 8, wherein said composite wrap (20) (page 2, line 26) is carbon or aramid and fiberglass.

16. The cylinder assembly (10) (page 2, line 19) of Claim 8, wherein said cylinder (14) (page 2, line 20) is structured to contain a gas at a pressure between about 500 to 10,000 psi.

Grounds of Rejection to be Reviewed on Appeal

Claims 1, 2, 6-9 and 14-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* (U.S. Patent No. 5,474,846) in view of *Seal et al* (U.S. Patent No. 5,822,838).

Claims 3-5 and 10-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* ('846) in view of *Seal* ('838) as applied to claims 2 and 9 and further in view of *Luttmann et al.* (U.S. Patent No. 6,244,020).

Claims 1, 2, 6-9 and 14-16; Rejected under 35 U.S.C. § 103(a).

Claims 1, 2, 6-9 and 14-16 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* (U.S. Patent No. 5,474,846) in view of *Seal et al.* (U.S. Patent No. 5,822,838). *Haldenby* discloses the use of a plastic coating on the inner side of a steel cylinder. More specifically, *Haldenby* discloses a method of applying the plastic coating and identifies various types of plastics that may be utilized. As for the actual cylinder, *Haldenby* simply discloses the use of "standard steel" (Col. 2, line 38) and "stainless steel" (Col. 3, line 1). *Haldenby* does not mention the use of an aluminum cylinder.

Seal discloses a thin metal lined, composite overwrapped pressure vessel; that is, a metal cylinder with an outer composite layer. The metals identified as part of the *Seal* invention are titanium alloys, including the common Ti-6Al-4V alloy. In the prior history portion of the disclosure, *Seal* further mentions aluminum-lined composite wrapped tanks. Col. 1, lines 39-44. *Seal* further indicates that a protective coating may be applied to the composite wrap. Col. 9, line 14. *Seal* does not, however, disclose the use of a coating on the inner surface of the metal shell.

With regard to the determination of obviousness under 35 U.S.C. § 103, the Supreme Court has recently stated that:

> Although common sense directs one to look with care at a patent application that claims as innovation the combination of two known devices according to their established functions, *it can be important to identify a reason that would have prompted a person of ordinary skill in the relevant field to combine the elements in the way the claimed new invention does*. This is so because inventions in most, if not all, instances rely on building blocks long since uncovered, and claimed discoveries almost of necessity will be combinations of what, in some sense, is already known.

KSR International Co. v. Teleflex Inc., ___ U.S. ___, ___, 2007 WL 1237837 (2007), (Slip Opinion at 14-15) (emphasis added). In addition, the Supreme Court also noted that:

> Often, it will be necessary for a court to look to interrelated teachings of multiple patents; the effects of demands known to the design community or present in the marketplace; and the background knowledge possessed by a person having ordinary skill in the art, all in order to determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue. To facilitate review, *this analysis should be made explicit*. See *In re Kahn*, 441 F.3d 977, 988 (Fed Cir. 2006) ("[R]ejections on obviousness grounds cannot be sustained by mere conclusory statements; instead, *there must be some articulated reasoning with some rational underpinnings to support the legal conclusion of obviousness*").

Id., at ___ (Slip Opinion at 14) (emphasis added). It is noted that the Supreme Court included an extended discussion reciting the nature of the inventions disclosed in the prior art and then several paragraphs identifying the rationale and reasons that the cited art could be combined and why one skilled in the art would make such a combination. *Id.*, at ___ (Slip Opinion at 3-6, 20-22).

With regard to combining known elements of an invention, the Supreme Court further stated that, "[A] patent composed of several elements is not proved obvious merely by demonstrating that each of its elements was, independently, known in the prior art." *Id.*, at ___ (Slip Opinion at 14). This holding comports with *In re Fine*,

837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988) which held that, although some of the cited references, individually, may have some of the claimed inventions' features, "one cannot use hindsight reconstruction to pick and choose among isolated disclosures in the prior art to depreciate the claimed invention." *Id.* at 1075. Instead, to reach the proper conclusion under §103:

> The decision maker must step backward in time and into the shoes worn by [a person having ordinary skill in the art] when the invention was unknown and just before it was made. In light of *all* the evidence, the decision maker must then determine whether...the claimed invention as a whole would have been obvious at *that* time to *that* person.

Id. at 1073-74. (emphasis added).

The Examiner has not properly supported the rejection under 35 U.S.C. § 103(a) and under *KSR International.* In the final Office Action, the Examiner merely identified selected elements from the cited art, *e.g.* a protective plastic coating on the inner side of a thick steel shell (*Haldenby*) and another reference that discloses an aluminum shell having a composite wrap (*Seal*). The Examiner then stated that, "[i]t would have been obvious to add the overwrap [of *Seal*] to reinforce the shell [of *Haldenby*] and make it capable of withstanding higher internal pressures," and, "[i]t would have been obvious to modify the metal of the shell to be aluminum to provide a metal of high strength to weight ratio to make the cylinder lighter for aerospace and rocket applications." These two sentences are the only statements regarding the motivation to combine the references with respect to the two independent claims, Claims 1 and 8.

Appellants believe that two conclusory sentences are not sufficient to qualify as an "articulated reasoning with some rational underpinnings to support the legal conclusion of obviousness" and that the Examiner has failed to make the analysis explicit. Such an explicit analysis would be similar to the analysis provided by the Supreme Court in *KSR International*, which noted the elements in question and detailed how one skilled in the art would assemble, and even alter, these elements to arrive at the invention recited in the patent at issue.

Moreover, the limited analysis provided by the Examiner has a number of logical flaws. First, the Examiner discusses a motivation to add a composite wrap to a steel cylinder. That is, the Examiner combines the *Seal* composite overwrap with the *Haldenby* steel vessel stating that such a combination would make the *Haldenby* steel vessel capable of withstanding higher internal pressures. Accepting this as true, however, does not mean that one skilled in the art would make such a modification. Such a modification would only be made, *i.e.* be obvious, if steel vessels were known to lack the strength to withstand high pressures. The Examiner has made no such assertion and has presented no evidence that steel vessels have been found lacking in strength. As such, the fact that one skilled in the art *could* add a composite wrap to a steel cylinder does not show that one skilled in the art *would* add a composite wrap to a steel cylinder.

Next, however, the Examiner makes the initial rationale for adding a composite overwrap to a steel cylinder moot by reasoning that one skilled in the art would also replace the *Haldenby* steel vessel with an aluminum vessel. Appellants note that *Seal* already provided for an aluminum vessel, or shell, as well as a composite overwrap. Thus, the Examiner has essentially, by circuitous route, applied the plastic coating from *Haldenby* to the composite wrapped aluminum shell of *Seal.* Appellants further note that the Examiner never asserts that there is a motivation to apply the protective plastic coating of *Haldenby* to the composite wrapped aluminum shell of *Seal* to prevent gases from reacting with the aluminum shell.

Appellants assert that the end result of the Examiner's circuitous route is that the lack of motivation to combine the various elements of the cited art has been obscured. That is, the Examiner has offered a "red herring" stating that one skilled in the art would, "add the overwrap [of *Seal*] to reinforce the shell [of *Haldenby*] and make it capable of withstanding higher internal pressures" but in the very next sentence, the Examiner takes away the "shell [of *Haldenby*]" and replaces the "shell [of *Haldenby*]" with an aluminum shell such as the one already disclosed in *Seal.* Thus, the Examiner has provided a false motivation to combine the references.

Appellants believe that the Examiner's proposed combination should be recast in a different light. That is, rather than asking the two questions: (1) would one skilled in the art incorporate the *Seal* composite overwrap on the *Haldenby* vessel having steel shell/plastic coating, and then, (2) would one skilled in the art replace the *Haldenby* steel shell with the *Seal* aluminum shell, the actual question should be, "would one skilled in the art who knows that plastic may be applied to a metal shell, as in *Haldenby*, add such a plastic coating inside the composite wrapped aluminum shell of *Seal?*" Appellants further believe the answer to that question is "no."

That is, a proper detailed analysis under *KSR International* should address the following. When one skilled in the art utilizes a composite wrapped shell, that artisan is aware that the composite wrap is the element used to provide structure and resist the deformation of the vessel due to internal pressure. The artisan is further aware that the shell is used as the gas impermeable barrier and that such a barrier does not materially enhance the strength of the vessel. Thus, the artisan would only have to decide what type of shell would be needed. As further set forth above, if the artisan knows that the gas will permeate through plastic to an unacceptable extent, then a metal shell is used. Conversely, if the artisan knows that the gas to be stored reacts with metal, then a plastic shell must be used. It is further noted that one skilled in the art would not use both a metal and plastic shell in a vessel with a composite overwrap. That is, there is no reason to include a plastic coating if the gas does not react with metal and, if the gas does react with metal, a plastic shell by itself is sufficient. Moreover, if the plastic shell was insufficient, *i.e.*, if the gas would permeate the plastic and would react with metal, providing a plastic lining would be pointless as the gas would simply permeate the plastic and then react with the metal.

Thus, under a proper detailed *KSR International* analysis, and contrary to the Examiner's assertion, there is no motivation to combine *Haldenby* and *Seal*. As there is no motivation to combine these references under *KSR International*, the Examiner appears to be simply identifying various elements found in the prior art and, based on hindsight, asserting that they could be combined. As noted above, this approach to

supporting a rejection under 35 U.S.C. § 103(a) has been rejected in *KSR International* as well as *In re Fine*.

Independent Claim 1 recites a gas cylinder comprising an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side. As these references cannot be combined under 35 U.S.C. § 103(a) and as the individual references fail to disclose a gas cylinder comprising an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side, the rejection of Claim 1 under 35 U.S.C. § 103(a) is improper and the Examiner's rejection should be reversed.

Claims 2, 6 and 7 each depend from Claim 1 and rely on their dependency for patentability.

Independent Claim 8 recites a cylinder assembly comprising a valve, an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side. As these references cannot be combined under 35 U.S.C. § 103(a) and as the individual references fail to disclose a cylinder assembly comprising a valve, an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side, the rejection of Claim 8 under 35 U.S.C. § 103(a) is improper and the Examiner's rejection should be reversed.

Claims 9 and 14-16 each depend from Claim 8 and rely on their dependency for patentability.

Accordingly, the rejection of Claims 1, 2, 6-9 and 14-16 under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* in view of *Seal* is improper and the Examiner's rejection should be reversed.

Claims 3-5 and 10-13; Rejected under 35 U.S.C. § 103(a).

Claims 3-5 and 10-13 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* ('846) in view of *Seal* ('838) as applied to Claims 2 and 9 and further in view of *Luttmann et al.* (U.S. Patent No. 6,244,020). The deficiencies of *Haldenby* and *Seal* are discussed above. *Luttmann* discloses a process for producing a filled, sealed, and sterilized container. A "container" as defined in *Luttmann* is a "pack[] ... which can be opened without the aid of tools." Col. 1, lines 17-19. Further, "use is made to a considerable extent of ring pull lids in can-like packs in the human and animal food sectors." *Id.* at lines 24-25. Such container has a "weakening" at the "lid" wherein the container is structured to rupture upon the application of force. It is further noted that high pressure cylinders for gases, such as those disclosed in *Haldenby* and *Seal* typically include a boss to which a valve may be coupled. To resist being expelled due to the high pressure within the cylinder and to create a seal capable of preventing the escape of the stored gas, such valves are typically threaded and must be installed/removed with the use of tools. Based on the foregoing, it is clear that the *Luttmann* container is not a high pressure device and, more importantly, *Luttmann* is non-analogous art.

As set forth in MPEP §2141.01, "[i]n order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned." *Id.* citing *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992). That is, as set forth in MPEP §2141.01(a) IV, in *Oetiker*, the Appellant claimed an improvement in a hose clamp which differed from the prior art in the presence of a preassembly "hook" which maintained the preassembly condition of the clamp and disengaged automatically when the clamp was tightened. The Board relied upon a reference which disclosed a hook and eye fastener for use in garments, reasoning that all hooking problems are analogous. The court held the reference was not within the field of Appellant's endeavor, and was not reasonably pertinent to the particular problem with which the inventor was concerned because it

had not been shown that a person of ordinary skill, seeking to solve a problem of fastening a hose clamp, would reasonably be expected or motivated to look to fasteners for garments.

Here, the invention is in the field of high pressure gas cylinders. That is, as set forth at page 2, line 5, the cylinder of the present invention is designed to contain gas at a pressure from 500 to 10,000 psi. To accommodate such pressures, fluids are transferred in and out via a valve assembly. Such containers do not have "weakenings" formed therein and do not use "lids" to seal the container. Thus, despite mentioning that the food containers are subjected to an "increased" pressure during sterilization, the *Luttmann* food container does not rise to the level of similarity found insufficient in *Oetiker*. That is, in *Oetiker* the invention was one type of hook and the cited art was another hook used in a different context. In this application, the invention relates to high pressure gas cylinders which are sealed with a valve assembly. Such high pressure gas cylinders are incompatible with a container that may be opened "without the aid of tools." As such, one skilled in the art of high pressure cylinders would not find the *Luttmann* reference to be relevant to problems associated with high pressure gas cylinders. Accordingly, *Luttmann* is non-analogous art.

Further, as set forth above, to support a combination of references under 35 U.S.C. § 103(a) and *KSR International*, the Examiner must provide an "articulated reasoning with some rational underpinnings to support the legal conclusion of obviousness" and that analysis must be explicit. Again, the Examiner has failed to present such an explicit analysis. That is, the Examiner has merely stated *Luttmann* discloses a coating that is a polyethylene copolymer that includes polypropylene. Based on this fact, the Examiner concludes that, "[i]t would have been obvious to modify the coating [of *Haldenby*] to be a polyethylene copolymer in order to get the benefit of another plastic material in addition to the benefit of polyethylene."

Just as with the prior rejection, the single conclusory sentence is not an "articulated reasoning with some rational underpinnings to support the legal conclusion of obviousness." Further, as set forth in *KSR International*, the Examiner

must provide a basis for the proposed combination. That is, in *KSR International* the Court noted one example of a proper motivation is a need or problem known in the field of endeavor. *KSR International* (Slip Opinion at 16). However, as set forth in the specification of the present application, there has not been a need to combine plastic coatings with composite wrapped metal shells because, as set forth in detail above, a composite wrapped plastic shell is sufficient to contain a gas that reacts with metal, and a composite wrapped metal shell is sufficient to contain all other gases. Therefore, one skilled in the art would not find a need to apply a plastic coating to a metal shell let alone convert the coating of *Haldenby* to be a polyethylene copolymer, as suggested by the Examiner.

Accordingly, the Examiner has failed to properly support the proposed combination of references under 35 U.S.C. § 103(a) and *KSR International* by failing to provide a detailed analysis. Moreover, when such a detailed analysis is performed, it is clear that one skilled in the art would not combine the references cited by the Examiner.

Claim 3, which depends from Claim 2, recites a gas cylinder comprising an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side, wherein the coating is a heat bonded polyethylene copolymer. As the Examiner has not properly supported a combination of these references under 35 U.S.C. § 103(a) and *KSR International*, and as the individual references fail to disclose a gas cylinder comprising an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side, wherein the coating is a heat bonded polyethylene copolymer, the rejection of Claim 3 under 35 U.S.C. § 103(a) is improper and the Examiner's rejection should be reversed.

Claims 4 and 5 depend, directly or indirectly, from Claim 3 and rely on their dependency for patentability.

Claim 10, which depends from Claim 9, recites a cylinder assembly comprising a valve assembly, an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side, wherein the coating is a heat bonded polyethylene copolymer. As the Examiner has not properly supported a combination of these references under 35 U.S.C. § 103(a) and *KSR International*, and as the individual references fail to disclose a gas cylinder comprising a valve assembly, an aluminum shell having an outer side and an inner side defining a storage space, a composite wrap disposed about the aluminum shell, and a plastic coating disposed on the inner side, wherein the coating is a heat bonded polyethylene copolymer, the rejection of Claim 10 under 35 U.S.C. § 103(a) is improper and the Examiner's rejection should be reversed.

Claims 11 and 12 depend, directly or indirectly, from Claim 10 and rely on their dependency for patentability.

Accordingly, the rejection of Claims 3-5 and 10-13 under 35 U.S.C. § 103(a) as being unpatentable over *Haldenby* in view of *Seal* and *Luttmann* is improper and the Examiner's rejection should be reversed.

Conclusion

It is submitted that Claims 1-16 are patentable over the prior art. Therefore, it is requested that the Board reverse the Examiner's rejections of Claims 1-16 and remand the application to the Examiner for the issuance of a Notice of Allowance.

Respectfully submitted,

David C. Jenkins
Registration No. 42,691
Eckert Seamans Cherin & Mellott, LLC
600 Grant Street, 44th Floor
Pittsburgh, PA 15219
(412) 566-1253
Attorney for Appellants

CLAIMS ON APPEAL

1. A gas cylinder comprising:

an aluminum shell having an outer side and an inner side defining a storage space;

a composite wrap disposed about said aluminum shell; and

a plastic coating disposed on said inner side.

2. The gas cylinder of Claim 1, wherein said plastic coating is heat bonded to said inner side.

3. The gas cylinder of Claim 2, wherein said plastic coating is a polyethylene copolymer.

4. The gas cylinder of Claim 3, wherein said storage space is between about 0.5 and 500 liters.

5. The gas cylinder of Claim 4, wherein said composite wrap is carbon or aramid and fiberglass.

6. The gas cylinder of Claim 1, wherein said storage space is between about 0.5 and 500 liters.

7. The gas cylinder of Claim 1, wherein said composite wrap is carbon or aramid and fiberglass.

8. A cylinder assembly comprising:

a valve assembly structured to sealingly engage a cylinder; and

a cylinder comprising:

an aluminum shell having an outer side and an inner side defining a storage space;

a composite wrap disposed about said aluminum shell; and

a plastic coating disposed on said inner side.

9. The cylinder assembly of Claim 8, wherein said plastic coating is heat bonded to said inner side.

10. The cylinder assembly of Claim 9, wherein said plastic coating is a polyethylene copolymer.

11. The cylinder assembly of Claim 10, wherein said storage space is between about 0.5 and 500 liters.

12. The cylinder assembly of Claim 11, wherein said composite wrap is carbon or aramid and fiberglass.

13. The cylinder assembly of Claim 12, wherein said cylinder is structured to contain a gas at a pressure between about 500 to 10,000 psi.

14. The cylinder assembly of Claim 8, wherein said storage space is between about 0.5 and 500 liters.

15. The cylinder assembly of Claim 8, wherein said composite wrap is carbon or aramid and fiberglass.

16. The cylinder assembly of Claim 8, wherein said cylinder is structured to contain a gas at a pressure between about 500 to 10,000 psi.

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

Examiner: Stephen J. Castellano	Appeal No. 2007-1112 Dated July 19, 2007
Group Art Unit: 3781	
In re Application of: RONALD CAUDILL ET AL.	ALUMINUM CYLINDER WITH A PLASTIC COATING
Serial No. 10/692,116	
Filed: October 23, 2003	Attorney Docket No. 282660-00247

AFFIDAVIT OF ED SCHINDLER

I, Ed Schindler, hereby declare that:

1. I have 14 years of experience as a manufacturing / project / design engineer in composites industry. I have dedicated 7 years in manufacturing and design of pressure vessels. During this time I have participated as a key person in the design and manufacturing of various configurations of pressure vessels, with operating pressures up to 10, 000 psi. These vessels obtained worldwide recognition as proven by certifications awarded by various governmental agencies as KHK (Japan), TC (Canada), TUV (Europe), DOT (USA). The end application of these vessels includes, but is not limited to, fireman air breathing apparatus, alternate fuel tanks for motor vehicles (*e.g.* Natural Gas, Hydrogen), satellite propellant tanks, medical, and commercial aircraft industries.

I have a degree in Manufacturing Engineering obtained from the University of Brasov, Romania.

2. In the field of designing high pressure cylinders used to store gases, it is known that a plastic coating can be applied to metal cylinders, and in particular to steel cylinders, for preventing chemical attack by reactive gases. See for example, *Haldenby* (U.S. Patent No. 5,474,846).

3. In such high pressure cylinders the pressure retaining capability of the vessel is substantially provided by the metal shell. That is, the plastic lining does not provide any substantive pressure retaining capability. Thus, because the metal shell in an unreinforced metal cylinder provides the structural strength for the vessel, the

metal thickness of an all-metal vessel design will be greater than the metal liner thickness of a composite reinforced vessel if the pressure retaining capability and metal alloy are the same. It is known in the pressure vessel art that a thicker metal shell will endure more pressure cycles before fatigue failure as compared to a thinner metal shell.

4. Conversely, it is also well known within the pressure vessel industry that reduced metal thickness results in a shorter vessel fatigue life. In general, a thinner metal wall thickness will be less capable of withstanding fatigue stresses. In addition, once fatigue cracking initiates, it takes less time and fewer pressure cycles for the cracking to propagate through a thinner metal wall.

5. High pressure cylinders having a thin metal shell must have a composite overwrap. See, *e.g.*, *Seal et al.* (U.S. Patent No. 5,822,838). In such cylinders, the thin metal shell does not provide substantive pressure retaining capability within the vessel structure. Rather, the structural strength of such a vessel is created by the composite overwrap. Thus, the thin metal shell is, essentially, used to create the impermeable barrier for the gas. A plastic shell can also be used in place of a metal shell, however, plastic shells tend to be more permeable. Thus, plastic shells can be employed when the stored fluid is chemically reactive with metals.

As the primary function of the shell in a composite overwrap high pressure cylinder is to create a gas impermeable barrier, a designer typically chooses the shell material to correspond to the gas being stored. If the gas being stored is not chemically reactive, a metal shell can be used. If the gas being stored would react with a metal, a plastic shell can be used.

A designer would not, however, use both a metal shell and a plastic shell under a structural composite overwrap. Metal shells would be used if the gas was non-reactive with a metal shell and the permeation rate with a plastic shell was unacceptable. That is, there would be no need to add the non-reactive plastic shell. A plastic shell would be used if the gas was reactive with a metal shell and the permeation rate was acceptable. There would, however, be no need to combine an impermeable metal shell and a plastic shell. If unacceptable permeation occurred with a plastic shell and the gas was metal-reactive, the gas would not be suitable for storage. That is, if a metal shell with a plastic coating was used, the plastic-permeable and metal-reactive gas would permeate the plastic then react with the metal.

6. Plastic coatings may also be used as a break-away seal material for opening sterilized containers without the aid of a tool. See, *e.g.*, *Luttmann et al.* (U.S. Patent No. 6,244,020). Such a plastic lining is generally used to seal the vessel, that is, prevent a fluid such as, but not limited to, air from entering or escaping the vessel. Again, such plastic coatings do not materially enhance the strength of the vessel.

7. Further, it is understood in the art that a high pressure cylinder is a reusable device. That is, a typical high pressure cylinder is expected to last several years and be refilled multiple times. Even expendable high pressure cylinders, such as high pressure cylinders used in rockets, are expected to be filled and emptied for testing purposes. The *Luttmann* device, however, relates to a destructible container. That is, the *Luttmann* device is structured to be filled a single time, possibly sterilized, and then destroyed when opened. As such, *Luttmann* is not a reference one skilled in the art of reusable high pressure cylinders would look to.

8. The internal plastic coating of the Caudill vessel produces a different result and performs a different function than the plastic coatings disclosed by *Haldenby* and *Luttmann*. Caudill discloses that a plastic coating can be installed on aluminum lined, composite reinforced pressure vessels for increasing the vessel fatigue and pressure cycle life. In particular, it has been found that the plastic coating redistributes and reduces pressure related stress concentrations around critical fatigue prone areas of the metal liner, such as around curves and contour changes. These stress related properties of plastic coatings are especially critical for composite reinforced vessels. To minimize weight, composite reinforced vessels are designed so the relatively lightweight composite materials bear at least some portion of the pressure loading so that less metal is needed in the vessel structure.

Accordingly, the effect of the plastic coating on a metal vessel wrapped in a composite produces a result that would not occur in a thick walled metal high pressure cylinder of the prior art. That is, because the thick walled metal high pressure cylinders of the prior art were less susceptible to fatigue related failure, the enhanced fatigue resistance provided by plastic coatings on relatively thin metal shells of composite reinforced vessels were not realized. The Caudill vessel, however, produces an unpredicted result in that the plastic coating enhances/extends the life cycle of a high pressure cylinder having a thin aluminum shell that is reinforced by a composite wrap.

9. It is further noted that the effect of the plastic coating on a metal vessel wrapped in a composite was sufficiently unexpected that one customer of Harsco, the assignee of U.S. Patent Application 10/692,116, requested an external analysis of such a vessel to explain how the cycle life was improved. This report was prepared by Dr. Allen Selz, Ph.D., P.E. of Pressure Sciences Incorporated. A version of this report, which has been edited to remove information relevant to the customer, is attached as Exhibit B. This report noted that plastic coating helped relieve, *i.e.* redistribute, stress concentrations at a microscopic scale at selected locations. The original report was not prepared in relation to U.S. Patent Application 10/692,116.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

9/17/07
Dated

FRIEDRICH (ED) SCHINDLER
NAME

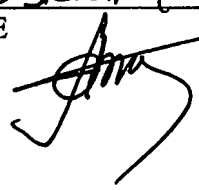

Exhibit A

Pressure Sciences Incorporated
3315 Meadow Wood Drive
Richardson, TX 75082-3787
Telephone: 972-480-8680
Facsimile: 972-480-8682
www.press-sci.com

Serial No. 04014-004
September 8, 2007

Our Nineteenth Year

Ronald L. Caudill
Structural Composites Industries
325 Enterprise Place
Pomona, CA 91768

Re: Opinion on Fatigue Resistance of Lined Composite Cylinder

Dear Mr. Caudill:

Structural Composites Industries has asked me to explain an empirical observation that SCI has made in the course of testing the cyclic life of its filament-wound vessels. These pressure vessels are manufactured by filament winding over an aluminum substrate; and SCI has demonstrated that the presence of a polymer coating on the interior of the aluminum increases the cyclic life.

Background

The SCI composite vessels consist of a 6061-T6 aluminum alloy liner, several layers of carbon filament helical and hoop winding and several layers of glass filament helical and hoop winding on the exterior; and a 2.5 mm thick polymerized plastic interior coating. The plastic coating was developed by experimental methods and is called Aegis-17. It is mechanically similar to polyolefin.

Test specimens of the composite vessels have been exposed to cyclic pressure loading until failure occurs. The failures occur by cracking of the cylindrical portion of the aluminum liner.

It was found that the presence of the plastic coating increased the fatigue life of the cylinder significantly. SCI requested that I provide a qualitative explanation for this increase in cyclic life.

Clearly, the cyclic life of the composite vessel is the cyclic life of the aluminum liner: When the liner fails, the vessel fails.

It is well known that metal fatigue life is dependent on a number of factors. Among these, the ones that might affect the life of aluminum liner are stress-concentration, surface finish, and, of course, the magnitude of the cyclic stress. There are several ways in which an inner polymer layer could increase the cyclic life of a vessel. These are described below.

Stress Concentration

Macroscopic stress concentration, for example at the point where the cylindrical shape makes the transition to the spherical shape of the head, and where the windings make a similar transition, will be unchanged whether or not there is a polymer coating present. However, on a microscopic scale, local surface discontinuities can serve as stress-concentration sites for the initiation and propagation of a flaw. The internal pressure will load the shell normally to the local surface of the shell. In the presence of roughness or tooling imperfections, this creates very localized maldistributions of stress. The presence of a polymer coating over the metal substrate will tend to distribute local loads near any microscopic discontinuities in the shell and therefore mitigate failure due to defects in the metal surface.

Reduction in Stress

The presence of an additional (polymer) layer, even with a low stiffness compared with the stiffness of the aluminum liner and the filament windings will clearly mitigate the hoop stresses in the aluminum and in the filament windings.

Simple hand calculations were performed in two ways. First, without autofrettage, and assuming elastic behavior, I found that the preponderance of the pressure is resisted by the filament layers, and only about 6 percent is resisted by the aluminum. Furthermore, the decrease in cyclic stress in the aluminum liner with the added polymer coating is only about 0.2 percent. This is not sufficient to explain the large increase in fatigue life.

Next, I used calculation output provided by SCI. This output included autofrettage and inelastic behavior, but did not include a polymer coating. Because of the autofrettage, the stress in the aluminum during the test phase of the analysis was found to significantly increase. However, the aluminum resists only about 8 percent of the pressure load: The filament layers still take the preponderance of the load. Based upon the analysis without autofrettage and the earlier discussion of stress concentration, it is clear that the mechanical effect of the polymer coating

is not to significantly reduce the stress in the aluminum, but instead to mitigate very local stress concentration effects.

Conclusion

It is not likely that the observed increase in fatigue life is caused by a reduction in stress due to the presence of the coating. It is most likely that the increase in fatigue life is due to reductions in microscopic stress concentrations and consequent reductions in fatigue-induced crack-growth rate.

Very truly yours,
Pressure Sciences Incorporated

Allen Selz, Ph.D., P.E.
President

Very truly yours,
Pressure Sciences Incorporated

Allen Selz, Ph.D., P.E.
President